

**UPPER RESPIRATORY TRACT INFECTIONS AND THEIR
ASSOCIATION WITH KNOWLEDGE, ATTITUDE AND
PRACTICE AMONG MALAYSIAN HAJJ PILGRIMS OF 2007 A.D
(1428 H)**

By

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**Thesis submitted in fulfillment of the
requirements for the degree of
Master of Science
(Pharmacy)**

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DEDICATION

To

By the name of Allah the most beneficent

I dedicate this thesis to

my great father and mother

my mother in law

my brother and my sisters

my beloved husband Ahmed Yassin and my lovely daughters Basma and

Tanya

without their loves and encouragements this thesis would not be
materializes.

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LIST OF ABBREVIATIONS

ACIP	Advisory Committee on Immunization Practice
A.D	Anno Domini
AIDS	Acquired Immune Deficiency Syndrome
ARI	Acute Respiratory Infection
CAM	Complementary and Alternative Medicine
H	Hijrah
HIV	Human Immunodeficiency Virus
HSV	Herpes Simplex Virus
KAP	Knowledge, Attitude and Practice
ILI	Influenza Like Illnesses
LRTI	Lower Respiratory Tract Infection
RTIs	Respiratory Tract Infections
RSV	Respiratory Syncytial Virus
RT	Respiratory Tract
SARS	Severe Acute Respiratory Syndrome
SPSS	Statistical Package for Social Sciences
UK	United Kingdom
URTI	Upper Respiratory Tract Infection
URTIs	Upper Respiratory Tract Infections
USA	United States of America

**JANGKITAN-JANGKITAN TREK RESPIRATORI ATAS DAN
PERKAITANNYA DENGAN PENGETAHUAN, SIKAP DAN AMALAN
DIKALANGAN JEMAAH HAJI MALAYSIA TAHUN 2007 A.D (1428 H)**

ABSTRAK

Setiap tahun lebih dari dua juta Muslim daripada lebih 140 negara menunaikan ibadat haji di Mekah dan Madinah. Ada beberapa faktor yang menyumbang kepada sbaran meluas URTIs (jangkitan-jangkitan trek pernafasan atas), termasuklah pernafasan diudara yang tercemar, sentuhan terus dengan orang yang dijangkiti, tempat-tempat yang sesak, menghisap rokok dan pendedahan kepada patogen. Salah satu jangkitan yang paling sering dialami oleh jemaah haji adalah URTIs. Berdasarkan rujukan-rujukan dan repot-repot, penyebab utama adalah virus-virus. Walaubagaimana pun hanya peratusan yang kecil mungkin berisiko mendapat komplikasi sekunder. Kajian ini bertujuan untuk menilai insiden URTIs dan tahap keterukannya, pengetahuan, sikap dan amalan terhadap URTIs dan pencegahannya dikalangan Jemaah Haji Malaysia. Kajian keratan-rentasan telah di jalankan dari bulan Disember 2007 hingga Januari 2008 di Mekah dan Madinah, Saudi Arabia yang melibalkan 2211 Jemaah Haji Malaysia(1428H). Borang soal selidik diisi-sendiri yang telah di validasikan telah disebar dan digunakan untuk pengambilan data. Program statistik SPSS versi 15.0 di mana ujian-ujian Chi-kuasa dua dan Perhubungan Pearson telah di gunakan dengan nilai $P < 0.05$ di anggap sebagai signifikan statistik. Kadar respon dalam kajian ini adalah 73.7%. Didapati lebih daripada separuh adalah wanita. Kebanyakan mereka adalah berketurunan Melayu dengan purata umur 53 ± 10 tahun. Kebanyakan (86.6%) Jemaah Haji Malaysia mengalami URTIs; walaubagaimana pun hanya 12.4% mengalami URTIs bertahap teruk. Status akademik dan jantina yang didapati menyumbang terhadap tahap keterukan URTIs. Simptom yang sering dialami adalah

batuk. Lebih sedikit dari separuh mengalami demam. Didapati 32% dan 33.1% jemaah, masing-masing mempunyai tahap pengetahuan dan sikap yang baik tentang URTIs dan cara mencegahnya. Lebih dari dua pertiga (69.1%) jemaah mempunyai amalan yang baik terhadap pencegahan URTIs. Tahap pengetahuan mempunyai kaitan statistik dengan status akademik dan pendapatan bulanan mereka. Umur, status akademik dan pendapatan bulanan mereka di anggap sebagai faktor penyumbang terhadap tahap sikap. Terdapat perkaitan signifikan statistik diantara tahap-tahap KAP. Tahap keterukan URTIs dan tahap sikap tidak menunjukkan ada kaitan signifikan statistik. Lebih sedikit daripada separuh (58.8%) jemaah haji menerima antibiotik sebagai rawatan URTIs. Kebanyakan mereka menyatakan meminta antibiotik apabila mengalami URTIs. Kesimpulannya, kajian ini menunjukkan kebanyakan Jemaah Haji Malaysia dijangkiti URTIs. Jemaah haji yang mempunyai pengetahuan yang baik didapati mengalami URTIs yang kurang teruk. Oleh itu, di percayai program pembelajaran dan perubahan tingkahlaku boleh memperbaiki tahap KAP bagi mengurangkan insiden dan keterukan URTIs. Perlaksanaan panduan antibiotik URTIs untuk jemaah haji boleh mengurangkan penggunaan antibiotik dalam keadaan yang tidak di perlukan.

UPPER RESPIRATORY TRACT INFECTIONS AND THEIR ASSOCIATION WITH KNOWLEDGE, ATTITUDE AND PRACTICE AMONG MALAYSIAN HAJJ PILGRIMS OF 2007 A.D (1428 H)

ABSTRACT

Each year more than two million Muslims perform the hajj rituals, in Makkah and Medina from over 140 countries. There are several factors contributing to the wide spread of URTIs, which include breathing of contaminated air, direct contact with infected people, over-crowded places, cigarette smoking and exposure to pathogens. One of the most common infections contracted by hajj pilgrims is URTIs. Based on references and reports, the most common causes are viruses. However, a small percentage of URTIs patients may develop secondary complications including bacterial infections. This study is aimed to evaluate the incidence URTIs and their level of severity as well as the level of knowledge, attitude and practice towards URTIs and their prevention among Malaysian Hajj Pilgrims. A cross-sectional study was carried out from December 2007 to January 2008, in Makkah and Medina, Saudi Arabia which involved 2211 Malaysian Hajj Pilgrims (1428H). Validated self-administered questionnaire forms were distributed and used for data collection. Chi-square and bivariate correlation tests from statistical program SPSS version 15.0 were used for data analysis and $P < 0.05$ was considered as statistically significant. The response rate of this study was 73.7%. It was found that more than half were women. Majority of respondents were Malays with mean age 53 ± 10 years. The majority (86.6%) of respondents had URTIs; however only 12.4% had severe URTIs. The education status and gender contributed to severity level of URTIs. The most common symptom was cough. Slightly less than half had fever.

It was found that 32% and 33.1% of them had good knowledge and good attitude towards URTIs and their prevention respectively. More than two third (69.1%) of them had good practice towards URTIs prevention. Knowledge level was statistically associated with educational status and monthly income. Age, education status and monthly income were considered as predisposing factors, which contributed to the attitude level. There was a significant association between the KAP levels. The association between severity level of URTIs and attitude level was not statistically significant. Slightly more than half (58.8%) of them received antibiotics for URTIs treatment. Majority stated requested antibiotics when having URTIs. In conclusion, this study showed that majority of respondents had URTIs. Hajj pilgrims who had good knowledge represented to be less severe URTIs. Thus it's believed that further educational programs and behavior modification would improve KAP level to reduce the incidence and severity of URTIs. Implementation of proper antibiotic guidelines on URTIs would minimize the unnecessary use of antibiotics.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Many studies have assessed the incidence of respiratory tract infections and their associated risk factors among hajj pilgrims from different countries. About 50% of hajj pilgrims developed upper respiratory tract infections during the first week of pilgrimage (Balky *et al.*, 2004). A study performed by Rashid *et al.*, (2005) demonstrated increased respiratory infections caused by influenza and other viruses among United Kingdom (UK) Hajj Pilgrims during the winter season. Based on blood tests for influenza among hajj pilgrims before departure and after they returned from hajj, the rate of influenza attack was found to be 38% among UK pilgrims and only 30% of the pilgrims who had been vaccinated. In this report, the authors suggested that all pilgrims should be vaccinated against influenza before traveling to the hajj, especially during the winter season. Another study reported by Qureshi *et al.*, (2000) found that the attack rate for influenza-like illness (ILI) was 62% among Pakistani pilgrims. However Shafi *et al.*, (2004) estimated that the prevalence of influenza A infection among UK pilgrims during the 2004 Hajj season was 6%.

Broad diagnosis of respiratory tract infection (RTI) includes the two principal sub-diagnoses of lower respiratory tract infection (LRTI) and upper respiratory tract infection (URTI), although it is often difficult to distinguish between them. Upper respiratory tract infections (URTIs) are defined as acute febrile illnesses presenting with cough, coryza, sore throat, or hoarseness, which are very common in the community and are one of the major reasons for visiting primary care physicians,

particularly during the winter season (Macfarlane *et al.*, 1993). The vast majority of URTIs cases are benign, so additional investigation to identify the precise etiology is not justified in routine practice. The URTIs management decisions by primary care physicians are normally based on etiologies for this type of infections. Data in the literature regarding these etiologies are based primarily on studies that did not utilize advanced diagnostic techniques (Billas, 1990; Macfarlane *et al.*, 1993).

Prospective studies were conducted to identify the etiological agents of URTIs in adults. Viruses such as influenza A and B viruses, adenovirus, respiratory syncytial virus, parainfluenza viruses, and Epstein Barr virus are some of the main etiologies for URTIs. The main bacteria that are responsible for causing URTIs include *Chlamydia pneumoniae*, *Legionella spp.*, *Mycoplasma pneumoniae*, *Haemophilus influenzae*, and *Streptococcus pneumoniae*. URTIs may be caused by a broad spectrum of etiological agents, and a considerable number of patient's present evidence of infection with more than one pathogen (Lieberman *et al.*, 1996; Lieberman *et al.*, 1998).

During a period of epidemic of URTIs between 1991 and 1992 hajj seasons, sputum specimens and throat swaps were obtained from patients referred with symptoms of URTIs to one hospital and three dispensaries in Saudi Arabia. Bacterial and viral pathogens were detected with influenza A and adenovirus predominating. Thus, these two viruses should be considered in future prophylactic measures (EL-Sheikh *et al.*, 1998).

Al-Asmary *et al.*, (2006) estimated that acute respiratory tract infections were seen in one quarter of the patients at two Saudi Hajj hospitals. Factors that contribute to this infection include cigarette smoking, direct contact with infected pilgrims, intermittent use of surgical facemasks, and a failure to use alcohol based hand disinfection. The use of inappropriate surgical facemasks by pilgrims and medical personnel should be discontinued, and protective equipment such as N95 masks should be considered. In addition, regular use of alcohol- based hand scrub should be strongly encouraged.

A prospective cohort study conducted by Choudhry *et al.*, (2006), examining acute respiratory infection (ARI) among hajj pilgrims admitted to the primary health care center of Riyadh, found that the incidence of ARI was not significantly associated with sex, age, education level, as well as smoking. However, they found that the risk for illness was significantly increased among hajj pilgrims who had chronic medical problems especially diabetes mellitus. In addition, they estimated that the use of facemasks by men, but not the face covers used by women, was highly protective against ARI.

Studies examining knowledge, attitude, and practices (KAP) have been conducted in many different fields and in various countries, such as the USA (Toy *et al.*, 2005, Cepdes and Larson, 2006, Willis and Wortly, 2006), Iran (Askaian *et al.*, 2004, 2005, 2006), Italy (Angelillo *et al.*, 2000, Pavia *et al.*, 2003), Taiwan (Deng *et al.*, 2006), Laos (Tran *et al.*, 2007), Spain (Jornet *et al.*, 2007), India (Kumar *et al.*, 2006), England (Ibia *et al.*, 2005), and Saudi Arabia (Al-Hoqail, 2003).

A cross-sectional survey of residents at Western Pennsylvania Hospital during the 2003-2004 influenza season used anonymous questionnaires to collect demographics, health beliefs, attitudes, and medical knowledge data related to the influenza vaccine. The majority of the residents were aware that the influenza vaccine was being offered for free and 91.9% found that the vaccine was convenient. Their positive outlook regarding the health benefits, confident attitude and increased education regarding the influenza vaccination, contributed to a higher rate of influenza immunization (Toy *et al.*, 2005).

A systematic review of descriptive and intervention studies measuring KAP regarding antibiotics use for treatment of URTIs were conducted among Latinos in the United States. The findings showed that many Latinos in the United States self-prescribed antibiotics due to financial and sociocultural barriers. They also believed incorrectly that antibiotics help to treat viral infections. In addition, the study showed that 31% of respondents agreed that antibiotics should be available over the counter in the United States. About 26% of the respondents agreed that they should use non-prescribed antibiotics in order to treat URTIs (Cespedes and Larson, 2006).

Willis and Wortly (2006) conducted a study on nurse attitudes towards influenza infections and influenza vaccinations. They found that the rates of vaccination might increase as a consequence of the development of education programs, emphasizing the rationale for health workers vaccination.

Evaluation of the level of KAP regarding isolation precautions among medical students was very significant. The study also found that education strategies regarding

infection control issues should not only be concentrated on healthcare workers, but should also include the medical students in Iran (Askarian *et al.*, 2004).

Another study in Iran that depended on self-administrated questionnaires with both open and close-ended questions, focused on knowledge, beliefs, and attitudes related to Iranian dentists towards HIV infections. The study revealed many educational deficits among the dentists in relation to HIV infection and infection control (Askarian *et al.*, 2006b).

A study performed in Italy showed the importance of knowledge, attitude, and behavior regarding infection control among dental hygienists. The study suggested that educational programs are needed to improve knowledge about oral AIDS manifestations in order to support dentists in providing early diagnoses, as well as the correct use of procedures and universal precautions to prevent infections (Angelillo *et al.*, 2000).

Assessment of general practitioners' knowledge, attitude, and behaviors related to influenza pneumococcal vaccination of the elderly in Calabria, Italy revealed a great need for efforts to improve general practitioners' knowledge regarding influenza and pneumococcal vaccines, as well as their adherence to vaccination policies (Pavia *et al.*, 2003).

Another study examining KAP and sources of information relating to severe acute respiratory syndrome (SARS) among physicians staffing the SARS fever hotline

service in Taiwan showed that knowledge of SARS was generally good due to their sufficient source of information towards SARS (Deng *et al.*, 2006).

Evaluation of the beliefs, attitudes, and stigma associated with epilepsy in four districts of central Laos demonstrated that incorrect beliefs might lead to stigma or compliance with modern epilepsy treatment. They also found that, in many countries, education is the cornerstone of epilepsy management. Consequently, there is a need for improving health information and education at the community, primary health care worker, and leadership levels, which might be useful in reducing the stigma and increasing awareness of the epilepsy management (Tran *et al.*, 2007).

A study of KAP regarding risk factors associated with oral cancer held by dental hygienists working in private dental practices in the Spain community found a reduction in the morbidity and mortality of oral cancer via implementation of oral cancer prevention programs. The need for more education intervention for dental hygienists was also highly recommended (Jornet *et al.*, 2006).

Kumar *et al.*, (2006) evaluated the status of KAP among patients with diabetes in the context of complementary and alternative medicine (CAM) in an Indian community. They also assessed perceptions about the use of CAM and factors influencing knowledge of CAM and its usage. They concluded that the use of CAM in diabetes is highly common among patients undergoing treatment, and it is more frequent among patients with higher education levels and higher socio-economic status.

Evaluation of knowledge regarding compliance with principle judicious antibiotic usage among medical students was highly significant in 21 medical schools in New England. The study found that, for URTIs treatment, large gaps remain regarding the appropriate use of antimicrobial agents (Ibia, 2005).

Al-Hoqail (2003) found that misconceptions and incorrect beliefs existed towards acne among students in the Kingdom of Saudi Arabia during 2001. Based on the results found, the health education programs on acne should be carried out to improve understanding of this condition.

1.2 URTIs problems

Upper respiratory tract infections (URTIs) are the most widespread infectious illnesses in many communities. During hajj season, the hazards of URTIs have both local and international ramifications. URTIs are also the most common reason for interference with the performance of hajj ritual activities, as well as individual's daily activities, and can lead to respiratory tract (RT) complications. In addition, these diseases are difficult to be prevented due to the ease spreading of the infection from person to person, or even to the larger community. Muslim pilgrims returning home may also carry URTIs and spread the infections to others, which can cause these people to miss their work or school and can increase the total cost incurred by illness (due to antibiotic usage, other medications usage, an increased rate of physician visits, and potentially hospitalization). In Malaysia, very few studies have been conducted to assess URTIs and their association with KAP level of hajj pilgrims during hajj seasons. Thus, a study examining URTIs among Malaysian hajj pilgrims is needed.

CHAPTER 2

LITERATURE REVIEW

2.1 Background

Each year more than two million Muslims from over 140 countries throughout the world perform the hajj, the annual pilgrimage to Makkah, Saudi Arabia. Overcrowding, inadequate nutrition, excessive heat, exhaustion as a consequence of traveling, long walks to and within Makkah, and performing the hajj rituals represent conditions that aggravate the risk of transmission the infections, especially respiratory tract infections. The hajj environment provides an ideal setting for the transmission of upper respiratory tract infections among pilgrims. Accordingly, one of the common infections during hajj is the upper respiratory tract infections (URTIs) (Gatrad and Sheikh, 2005; Rashid *et al.*, 2005; Ahmed *et al.*, 2007).

Besides significant problems during the hajj season, international effects of URTIs are felt when hajj pilgrims return home, but no serious preventative action has been taken, unlike that targeting other infections such as Cholera and Meningococcal meningitis, which have been successfully controlled by Saudi Health Authorities (Al-Mudameigh *et al.*, 2003). Furthermore, URTIs are the most common community-acquired infectious diseases, which can affect both genders and different ages, especially the very young or the elderly people (Denny, 1995; Monto, 2002). Several factors contribute to the widespread prevalence of URTIs, including direct contact with infected people, climate changes, overcrowding, cigarette smoking, and exposure to allergens, all of which are the main contributing factors present in hajj environment. Under these circumstances, it was not surprising to find that almost 40%

of hajj pilgrims from Riyadh had an attack of URTIs during or immediately after the hajj performance. Such a high incidence of illness, despite the low rate of hospitalization, causes a significant burden to hajj pilgrims (Al-Mudameigh *et al.*, 2003; Gatrad and Sheikh, 2005).

The problems associated with this illness become more complicated since URTIs are one of the most transmissible diseases, associated with high secondary attack rates, especially via household contacts when hajj pilgrims return home (Memish 2002; Choudhry *et al.*, 2006). However, Gatrad *et al.*, (2006) reported that URTIs are the most common reason for which British hajj pilgrims seek medical consultation at the British Hajj Delegation Clinic in Makkah, as well as in Medina, Saudi Arabia.

2.2 Upper respiratory tract infections (URTIs)

Upper respiratory tract infections are common acute infections involving the nose, paranasal sinuses, pharynx, larynx, trachea, and bronchi. It is usually identified by the community as a common cold (Bove *et al.*, 2006). URTIs can be defined as an acute febrile illness with cough, coryza, sore throat, or hoarseness, which are very common in the community and are one of the major reasons for appointments to primary care physicians, particularly during the winter season (Macfarlane *et al.*, 1993; Fleming *et al.*, 2001).

According to the findings of Meneghetti (2006) and Abed and Boivin (2006), URTIs are the most common acute illness found in an outpatient setting which have a wide range of clinical manifestation that may vary from the common cold (mild and self-limiting) to a life threatening disease, such as epiglottitis.

2.3 Etiology of URTIs

Both viral and bacterial pathogens are considered to play an important role in the etiology of URTIs. Fungi, other microorganisms, and chemicals (such as powder or oil that accidentally penetrate into the lungs) could also function as causative agents for URTIs (Pray and Pray, 2004; Karevold *et al.*, 2006).

2.3.1 Viral infections

Most URTIs are viral in origin, with an associated low morbidity rate but a tendency toward certain complications, such as otitis media, tonsillitis, and sinusitis, which can contribute to morbidity (Kavaerner *et al.*, 2000). Viruses that are commonly responsible for human respiratory tract infections include influenza virus, parainfluenza virus, respiratory syncytial virus (RSV), adenovirus, rhinoviruses and coronavirus (Smith and Sweet, 2002; Mackie, 2003).

Balkhy *et al.*, (2004) mentioned in their study that 500 hajj pilgrims from different countries suffering from upper respiratory symptoms who were screened via throat swab for viral culture presented a wide range of viruses, including influenza A and B, parainfluenza, respiratory syncytial virus (RSV), adenovirus, herpes simplex virus (HSV), and enterovirus. They detected that 10.8% of them had positive viral cultures, 27% of them infected by influenza B, 24.1% HSV, 12.9% RSV, and 7.4% and 5.6% parainfluenza and influenza A, respectively. Influenza virus showed a high incidence in URTIs among pilgrims from different countries compared to other viruses obtained during microbiological tests performed in Makkah from 1991 to 1992 (El- Sheikh *et al.*, 1998). In addition, a study evaluating the incidence of influenza among pilgrims from Pakistan showed that the rates were 36% and 62% in influenza-vaccinated

pilgrims and non-vaccinated pilgrims, respectively (El- Sheikh *et al.*, 1998; Balkhy *et al.*, 2004). These results were based on clinical outcomes, excluding microbiological confirmation (Qureshi *et al.*, 2000; Balkhy *et al.*, 2004). Another cohort study was carried out among pilgrims from east London in 2003 during the hajj season to assess the risk of influenza infection. The results showed that the attack rate of influenza was lower among vaccinated pilgrims compared to non-vaccinated pilgrims (El- Sheikh *et al.*, 1998; El-Bashire *et al.*, 2004).

2.3.2 Bacterial infections

Bacterial pathogens are considered to be one of the causal etiological agents for URTIs. The main bacterial pathogens detected in URTIs patients are *Streptococcus pneumonia*, *Streptococcus pyogenes*, *Haemophilus influenza*, *Staphylococcus aureus*, *Neisseria meningitis*, *Mycobacterium tuberculosis*, *Bordetella pertussis*, as well as *Pseudomonas aeruginosa* (Pfaller *et al.*, 2001; Smith and Sweet, 2002; Canton *et al.*, 2006).

Other studies among hajj pilgrims during the hajj seasons of 1991 and 1992 in Makkah determined the incidence of URTIs and the type of bacteria that commonly caused URTIs. These studies found that in 1991, the *H. influenza* was the most common bacterial pathogen detected, followed by *Klebsiella pneumonia*, *Streptococcus pneumonia*, *Staphylococcus aureus*, and *Streptococcus pyogens*. In 1992, the predominant bacteria in epidemic infections were *Klebsiella pneumonia* and *Haemophilus influenza*, followed by *Streptococcus pneumonia* (El-Sheikh *et al.*, 1998).

2.3.3 Mixed viral – bacterial infections

Viruses as a whole are considered as the most common causative organisms responsible for URTIs; however, these viruses can lead to bacterial infections, resulting in mixed viral-bacterial infections. Mixed viral-bacterial respiratory infections are not very common, but they seem to be widespread, especially among children less than two years of age. The long period of disease associated with viral infections or antibiotic treatment failure for bacterial disease may lead to mixed viral-bacterial infections (Jokso-Koivisto *et al.*, 2006).

In the Netherlands, a case-control study assessing acute respiratory tract infections among general practice patients found that mixed infections were detected in 3% of case patients which may be due to the presence of viruses associated with the group A beta-*Haemolytic streptococci*. Accordingly, they concluded that mixed infections are more commonly observed in case patients than in control subjects (Gageldonk-Lafeber *et al.*, 2005).

2.4 Epidemiology of URTIs

URTIs are highly prevalent, especially in children between the ages of two and four years. Children less than six months old are relatively protected against community-based respiratory infections. The frequency of URTIs increases and becomes high during the second year of a child's life, and may increase again during child-bearing years. Parents may get an infection when exposed to their infected children who have respiratory infections. On the other hand, the frequency of respiratory infections decreases with increasing age of children (Monto, 1995; Rovers *et al.*, 2006). However, during the hajj season, the incidence of URTIs was high

among older pilgrims or among pilgrims with concurrent chronic diseases, such as diabetic mellitus, cardiovascular disease, liver disease, or lung disease (Memish *et al.*, 2003; Choudhry *et al.*, 2006).

2.5 Pathophysiology of URTIs

URTIs can occur as a result of invasion by the microorganisms into mucous surfaces of the upper respiratory tract (URT), followed by penetration into the mucosal and epithelial tissues. Host defense mechanisms might be inhibited, leading to damage of host cells (Bamberger and Jackson, 2001). The ability of bacterial pathogens to reach one or more of these steps can be increased in the presence of viruses. URTIs are also increased via enhanced adherence of bacteria to the host cells resulting in infections (Smith and Sweet, 2002).

2.6 Seasonality of URTIs

URTIs occur year round and their incidence increases especially during the rainy and winter seasons. Epidemics and mini-epidemics are most common during cold months, with a peak incidence in late winter to early spring. Humidity may also affect the prevalence of infections, as most viral URTIs agents thrive in the low humidity conditions of winter months (Monto, 2002; Shek and Lee, 2003). During hajj, URTIs are very common, especially when hajj season comes in winter, as reported for the last few years of hajj seasons (Memish, 2002).

2.7 Routes of URTIs transmission

Viruses responsible for causing URTIs are mainly transmitted by small particle in droplets, which are usually generated by coughing. These droplets can remain suspended in the air for an hour, and might lead to infection upon inhalation. The other route of transmission can involve large particle droplets, which travel less than one meter and might infect the nasal mucosa (Hall and McBirde, 1994; Hendley, 1998; Goldmann, 2001). The spread of secretions containing bacterial or viral pathogens could also occur by direct contact. A contaminated hand could expose the pathogens to either the nose or mouth, or exposure could occur via direct inhalation of respiratory droplets from an infected person when coughing or sneezing (Bamberger and Jackson, 2001; Monto, 2002). Upper respiratory tract infections are the most communicable infections faced by hajj pilgrims and transmitted among them by either direct contact or direct inhalation (Memish *et al.*, 2003; Razavi *et al.*, 2005).

2.8 Clinical manifestations of URTIs

The clinical manifestations of URTIs are variable depending on the causative organisms. Symptoms usually begin from one to four days after infection, and range from mild (associated mainly with the common cold) to more complicated symptoms (associated with life-threatening illnesses such as epiglottitis). The duration of illness is generally one to two weeks; however, during the first week of infection, most of patients become better and can normally perform their daily activities (Porter *et al.*, 2006). URTIs symptoms can be relatively mild. They may begin with sore throat, dry cough, and runny nose. The cough may then become more severe, and can be associated with sputum. The mouth and throat may become swollen and red. However, other symptoms such as nausea and vomiting may also appear but usually

associated with children (Hall and McBride 1994; Porter *et al.*, 2006). The severity of URTIs symptoms depends on the pathogens responsible for the infections. More severe symptoms such as muscle aches and fatigue are normally associated with influenza and parainfluenza infections. On the other hand, mild symptoms might be due to rhinovirus infections (Snow *et al.*, 2001; Gonzales *et al.*, 2001c).

Most uncomplicated URTIs cases in adults can subside spontaneously within two days, but few URTIs cases are complicated by either pneumonia or bacterial sinusitis (Gonzales *et al.*, 2001c; Pray and Pray, 2004). According to a prospective cohort study to evaluate the incidence of acute respiratory tract infections among hajj pilgrims in Riyadh, about 40% of the hajj pilgrims are considered to have ARI symptoms during and immediately after the hajj performance. Accordingly, the definition of ARI in the study was a hajj pilgrim who developed at least one of the following local symptoms (runny nose, sneezing, sore throat, cough with/without sputum, and difficulty in breathing) as well as at least one of the constitutional symptoms (fever, headache, and myalgia) after reaching Makkah (Al-Mudameigh *et al.*, 2003; Choudhry *et al.*, 2006).

2.9 Types of URTIs

Upper respiratory tract infections can be identified according to either the pathogens responsible for the infection or the characteristics of the illness. Furthermore, URTIs are a group of diseases ranging from the common cold to acute bacterial sinusitis, pharyngitis, non-specific URTIs, and influenza (Stefani, 2000; Wong *et al.*, 2006). Patients with URTIs can also be classified according to the anatomic localization of the prominent clinical signs and symptoms associated with the illness (Gonzales *et al.*, 2001c).

2.9.1 Common cold

The common cold is considered to be an acute illness of the URTIs and it is caused either by respiratory syncytial viruses that are capable of repeatedly infecting an individual or rhinoviruses that initiate infection only once. These viruses are experienced by people of all ages worldwide (Hendley, 1998; Monto, 2002). The common cold is characterized by malaise, sore throat, and low-grade fever, especially at the first time of onset. This illness can affect persons of all ages and are considered to represent a self-limited syndrome (Bauman and Burns, 2000; Simasek and Blandino, 2007).

2.9.2 Acute bacterial sinusitis

Acute sinusitis is a common infection of the paranasal sinuses that is usually associated with inflammation of the nasal and sinus mucosa. Sinus disease has been shown to occur in 90% of patients with the common cold. In the first few days of infection, the symptoms are likely to be due to a viral cause that leads to upper respiratory tract infection, but this infection may later become complicated by a

bacterial infection. The main pathogens responsible for bacterial infection are *Streptococcus pneumonia*, *Haemophilus influenza*, and *Moraxella catarrhalis*, although *Staphylococcus aureus* and *Streptococcus pyogenes* are isolated in rare cases (Winther and Gwaltney, 1994; Bamberger and Jackson, 2001). Some physicians suspect acute sinusitis when cold or influenza-like illnesses persist for several days, and associated mainly with nasal congestion, sinus discomfort or tenderness, fever, headache, maxillary toothache, and facial pain. The symptoms presented may differ in children and can include irritability, lethargy, snoring, mouth breathing, feeding difficulty, and hyponasal speech (Fagnan 1998; Hirschmann, 2002).

2.9.3 Pharyngitis

Pharyngitis is the most common cause of sore throat, leading to an increasing number of family visits to physicians as well as ambulatory pediatric care visits (Kimberly, 2002; Vincent *et al.*, 2004). *Streptococcus pyogens* is considered to be the main causative agent of pharyngitis in both children and adults (Jokso-Koivisto *et al.*, 2006; Wong *et al.*, 2006). The incubation period for pharyngitis ranges from one day to four days. Low-grade fever, fatigue, sore throat, coryza, and cough are the main symptoms suggesting the presence of pharyngitis.

2.9.4 Non-specific URTIs

These diseases are identified by a range of descriptive names, including acute infective rhinitis, acute rhinopharyngitis/nasopharyngitis, acute coryza, and acute nasal catarrh (Ressel, 2001).

Numerous viruses are considered to be causative agents for non-specific URTIs, including rhinoviruses, adenoviruses, respiratory syncytial viruses, parainfluenza, and enteroviruses (Wong *et al.*, 2006). Mucopurulent nasal discharge, nasal blockage, itchiness, sneezing, facial pain, and postnasal drainage with cough could be the main indications for the non-specific URTIs (Dykewicz *et al.*, 1998; Ho *et al.*, 1998).

2.9.5 Influenza

Influenza is caused by a virus that mainly attacks the upper respiratory tract (nose, throat, bronchi, and rarely the lungs). The infection usually lasts for about one week, and it is characterized by the sudden onset of high fever, myalgia, headache and severe malaise, non-productive cough, sore throat, and rhinitis. Most people recover within one to two weeks with or without requiring medical treatment. Influenza is considered as a serious condition in the very young, the elderly, and people suffering from medical conditions such as lung disease, diabetes, cancer, and kidney or heart problems. In such individuals, the infection may lead to severe complications such as pneumonia, which can result in death (Taubenberger and Layne, 2001; Nicholson *et al.*, 2003).

Influenza can be caused by one of the three types of influenza virus: influenza A, influenza B, or influenza C (Kesson, 2007). Influenza virus type A and B mainly lead to epidemic diseases, while influenza virus type C leads to sporadic disease in human beings (Taubenberger and Layne, 2001).

2.10 Prophylaxis and management of URTIs

URTIs are of a great concern, as they are one of the most frequent reasons for patients to visit their physicians and lead to prescription of many treatments including the antibiotics in the ambulatory setting especially in the United States, despite the fact that many of these infections are viral in nature; thus the antibiotic treatment is not necessary. In the USA, each year more than 37 million patients visit the emergency department and their physician's clinics in order to obtain treatment for their URTIs (Gonzales *et al.*, 2001a; Linder and Singer, 2003; Zuckerman *et al.*, 2007).

Many achievements have been obtained for vaccines, antiviral medications, as well as antibiotics in the treatment of URTIs. Improved management will require health care professionals to educate their patients about their susceptibility to infection and the severity of their illness. The management of URTIs depends on how soon the morbidity and mortality of the disease can be limited after the infection occurs (Simberkoff, 2001; Tashiro, 2006; Wong *et al.*, 2006). Physicians must evaluate their patient's beliefs, attitudes and perceptions about infections and their treatments, and then plan the interventions accordingly, so as to increase the chances of treatment success. Finally, proper management can reduce the mortality and morbidity rates associated with URTIs. It has become imperative for physicians to identify a specific etiologic diagnosis before initiating a therapy or to consider the diagnostic possibilities and then treat the patient with either antiviral or antimicrobial agents which are effective against the most likely pathogens responsible for URTIs (Garibaldi, 1985; Tashiro, 2006; Bhavnani *et al.*, 2007).

2.10.1 Non-pharmacological therapy

The major non-pharmacologically management route for URTIs is adequate rest. Other modes of management include drinking a lot of fluids, avoiding exertion, regular use of alcohol-based hand disinfectant, wearing surgical face masks, and discontinue the cigarette smoking (Al-Asmary *et al.*, 2006; Porter *et al.*, 2006). Furthermore, educational intervention like teaching the patients about the infections and the correct indications for their treatment especially the use of antibiotics could satisfy the patients, rather than directly prescribing the medications including the antibiotics (Wong *et al.*, 2006). Non-pharmaceutical advice was provided to a patient presenting URTIs in order to decrease the incidence of this infection (Fischer *et al.*, 2005).

The use of a simple surgical face mask can reduce the inhalation of aerosolized droplets of influenza and other airborne infections. Barrier masks can reduce the effects of pollution and dense smoke, which are mainly occurred in overcrowded places such as hajj. A study performed in Indonesia estimated that continuous use of a facemask during the hajj decreased the incidence of URTIs by up to 82% (Al-Mudameigh *et al.*, 2003; Memish *et al.*, 2003).

In Saudi Arabia, a study found that the common practice among hajj pilgrims as well as medical personnel of using inappropriate surgical facemasks in order to protect themselves against URTIs must be discontinued. They recommended that hajj pilgrims use N95 masks, which exhibit better protection against URTIs. In addition, the appropriate use of alcohol-based hand disinfectants should be strongly encouraged (Al-Samary *et al.*, 2006; Choudhry *et al.*, 2006).

2.10.2 Pharmacological therapy

2.10.2 (a) Viral vaccination

Vaccinations are important before traveling in order to reduce the risk of URTIs, as well as the risk of the international spread of infections (Steffen and Conno, 2005; Shafi *et al.*, 2008). Vaccination is the most important control measure for the prevention of influenza outbreaks in any population, and it can reduce the severity and complications that may appear after infections. Vaccine plays an effective role in decreasing the risk of illness, hospitalization, as well as death (Valley and Blue, 2002; Mayor *et al.*, 2004; Hayden and Pavia, 2006). On the other hand, Smith and Sweet (2002) found that successful vaccination against respiratory virus diseases might also lead to protection against bacterial diseases. However, prevention of URTIs by immunization or vaccination has gained a higher priority throughout the world and can decrease the risk of many complications such as pneumonia (Loeb *et al.*, 1999; Schonbeck *et al.*, 2005).

In Malaysia, Mustafa *et al.*, (2003) found that vaccination was effective in controlling clinic visits for influenza-like illnesses (ILI) among Malaysian Hajj Pilgrims during the hajj season of 2000 in Saudi Arabia. The authors also found that vaccination could play an important role in reducing dispensation of over-the-counter medications, as well as antibiotic utilization. As a result, a substantial savings to the health care system can be achieved. In addition, the effectiveness of influenza vaccine in their study was significantly higher than that previously reported. They recommended that governments together with significant numbers of hajj staff should

provide programs about influenza immunization and its effects in minimizing the incidence and risk of influenza among pilgrims before they go to Makkah.

A study was performed in Iran to determine the efficacy of influenza vaccine against clinically-defined influenza-like illnesses among Iranian hajj pilgrims in the 2003 and 2004 hajj seasons. They found that the efficacy of vaccination against influenza was about 5% in 2003, but it was not effective in the year 2004. Accordingly, they estimated that, in the year 2003, the main cause of influenza-like illnesses (ILI) among Iranian pilgrims was influenza virus; therefore, the vaccine was relatively effective. However, in 2004, the vaccine was not effective because the major cause of disease could not be due to influenza virus (Razavi *et al.*, 2005).

Qureshi *et al.*, (2000) suggested that influenza vaccine should be administered to hajj pilgrims before they enter Saudi Arabia to perform their hajj, since influenza virus is the main cause of URTIs in hajj, and it can lead to significant morbidity. While Fernandez *et al.*, (2007) concluded that more educational programs about influenza vaccine should be carried out among health care workers and patients, for whom such programs could increase their acceptance of vaccination.

2.10.2 (b) Chemoprophylaxis with antiviral drugs

Antiviral drugs are considered to be effective in reducing the mortality of URTIs. These drugs are mostly used to treat influenza. Antiviral chemoprophylaxis can act as an adjunct, but are not considered as a substitute for vaccination. They provide additional protection for high-risk group among adults, as well as children (Memish 2002; Nicholson *et al.*, 2003). There are two types of commercially available specific

antiviral therapies; the first are ion-channel blocker medications that include Amantadine (Symmetrel®) and Rimantadine (Flumadine®). These drugs are used as a prophylaxis and treatment of all type A influenza variants. The most common adverse effects associated with the use of these drugs are nausea, vomiting, and malaise, but orthostatic hypotension occurs occasionally with the use of Amantadine (Tremblay, 2004).

The newer class of antiviral drugs comprises the Neuramidase inhibitors, which include Oseltamivir and Zanamivir. These drugs are effective against influenza A and B, and can reduce the infection rate in unvaccinated persons if started shortly or immediately after exposure to infection (Bove *et al.*, 2006). Zanamivir is recommended for adults and children greater than 7 years of age, while Oseltamivir is recommended only for adults who have displayed uncomplicated influenza symptoms such as fever and cough. They are also effective for prophylaxis if administered within two days of starting the symptoms. In addition, Zanamivir exhibits benefits similar to vaccination (Valley and Blue, 2002; Hayden and Pavia, 2006). Neuramidase inhibitors play a vital role in reducing the duration of illness among pilgrims with URTIs. These drugs also reduce the spread of infection to household contacts when the pilgrims return to their home countries (Gatard *et al.*, 2006).

Prevention and treatment of influenza with antiviral drugs is based on fast diagnosis using Quick Vue® test. The QuickVue® Influenza test is a rapid immunodiagnostic test that is designed to detect the presence of the influenza A and B virus in patient nasal wash or nasal swab samples within 10 minutes. A positive test result is visually detected as a single red colored test line (Quach *et al.*, 2002; Agoritsas *et al.*, 2006; Rashid *et al.*, 2007).

A study performed by Rashid *et al.*, (2007) estimated the usefulness of the test for diagnosing influenza among pilgrims attending the hajj. They concluded that the QuickVue® test (which uses nasal swabs) is weakly sensitive for estimating influenza among hajj pilgrims. However, because of its high specificity and even higher likelihood ratio for positive tests, the QuickVue® test may still be a very valuable method for influenza detection especially at hajj.

2.10.2 (c) Antibacterial therapy

The use of antimicrobial medications especially the antibiotics to treat URTIs is very common, despite the fact that, for most URTIs, they are ineffective (Linder and Singer, 2003). Although many of these infections are viral in nature but many physicians prescribe antibiotics for most URTIs patients. Such inadequate use of antibiotics exposes patients to the adverse effects of antibiotics and to increase the prevalence of antibiotic-resistance to bacteria (Linder and Singer, 2003; Schonbeck *et al.*, 2005). About 30-70% of the URTIs patients expect antibiotics according to the duration of the infection, the severity of the symptoms, and the perception of patient towards the effectiveness of the antibiotics (Welschen *et al.*, 2004).

Many physicians continue to prescribe antibiotic drugs for URTIs with the knowledge that antibiotics do not help in cases of viral infections and despite the development of resistant bacterial strains. The factors that influence a physician's decision to prescribe antibiotics for URTIs patients are: their belief that it is a bacterial disease, the fear that viral infection will lead to a secondary bacterial infection, and physicians belief that the patient expects to receive antibiotics for his illness to relieve the symptoms and shorten the duration of the disease (Macfarlane, *et al.*, 1997; Gonzales *et al.*, 2001b; Zuckerman *et al.*, 2007).